



## Solving Rural Broadband Economics

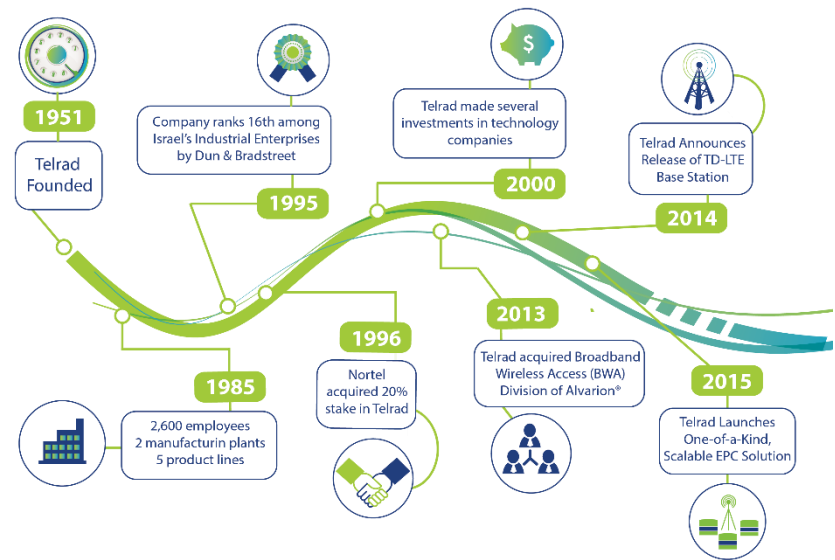
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# Telrad Networks: A 60+ Year Telecom Legacy

- Founded in 1951
- HQ in Lod, Israel
- Backed by Fortissimo Capital
- Part of the Telrad Group



**Telrad**   
We're on your wavelength.

**Magalcom**   
whatever IT takes

**Oasis**   
When IT (really) matters

**Telrad** 

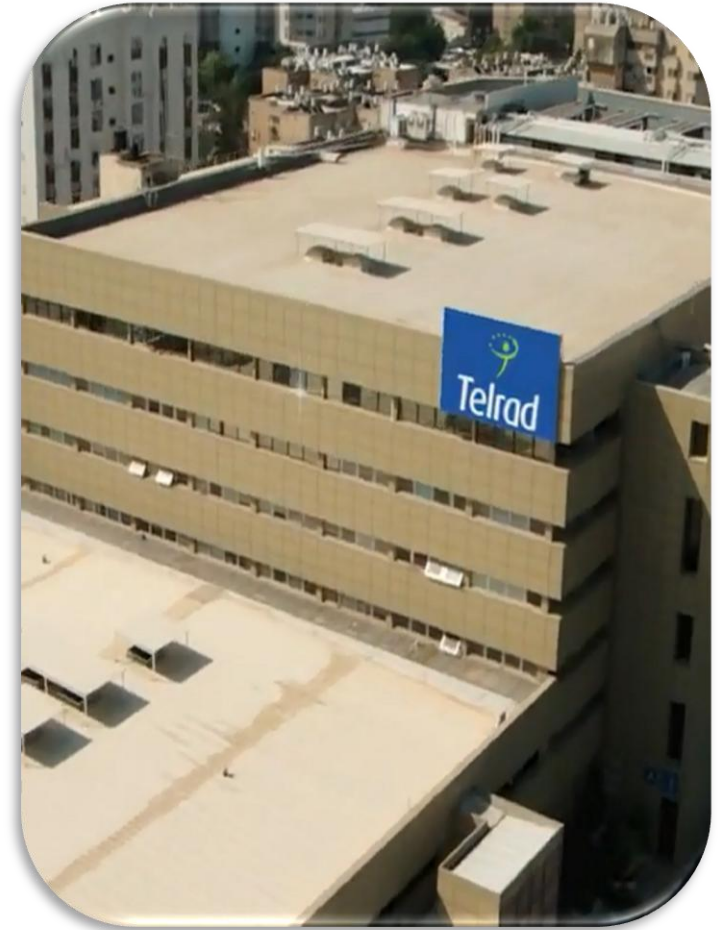
# Telrad's Focus and Mission

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Deliver the industry's best  
End2End TDD - LTE solutions

Optimized for "Fixed" Broadband  
Wireless Access

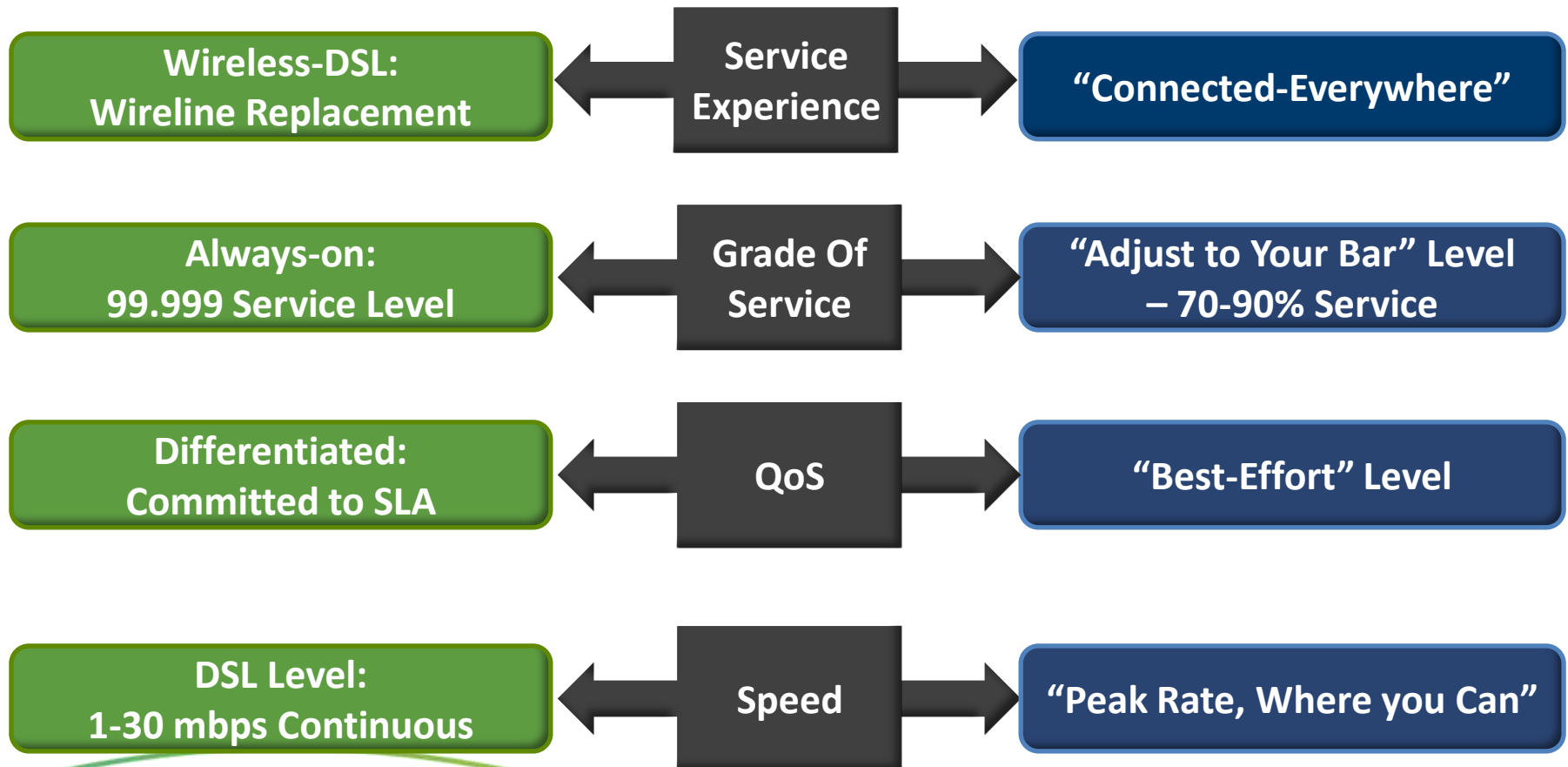
At a price that enables the  
quickest ROI possible.



# Fixed vs. Mobile LTE

## *BWA Fixed*

## *Broadband Cellular Mobile*



# What's impacting the Fixed Wireless Network?

APPS Continue  
Drive Demand



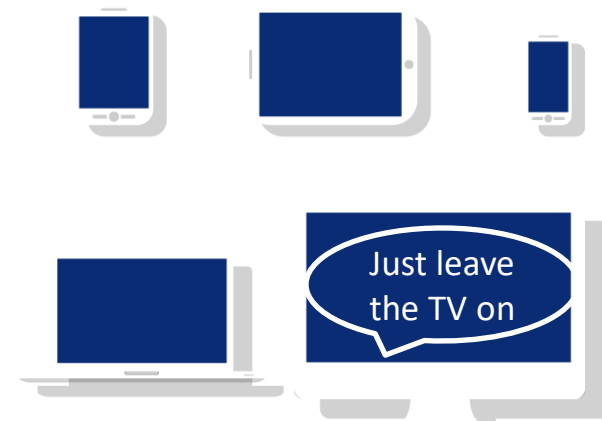
+ Games  
+ Mapping  
+ Shopping  
+ Web Browsing

OTT  
Devices Abound



2010 **4.5%** HH Cut the cord  
2016 **21.9%** or 26.7M households

Multiple  
Streams Per  
Home are common



- HD Stream/**Ultra HD**  
The trend is multiple streams per home

# Fixed Broadband Options

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- ADSL2+
  - ▶ Provides up to a 6Mbps DL service
  - ▶ Requires fiber to a DSLAM at 15kft or less from the subscriber
- VDSL
  - ▶ Provides true broadband of 25Mbps
  - ▶ Requires fiber to a DSLAM at 5kft or less from the subscriber
- FTTH
  - ▶ Services of up to 1Gbps currently offered
  - ▶ Major investment in providing fiber to the customer premise



# The Fixed LTE Alternative – Broadband with an ROI

- Capable of delivering quality broadband
  - ▶ 5Mbps – 25Mbps services (depending on avail spectrum)
  - ▶ Consistent “wireline like” performance
- Fiber or wireless backhaul to fewer locations
  - ▶ Providing backhaul only
  - ▶ One connection for every 150-300 subscribers
- Lower average cost per user than fiber and xDSL
  - ▶ \$500 - \$750 per subscriber in most cases
  - ▶ Lower OPEX and installation costs
- ROI in months not years



# Telrad E2E LTE – a Comprehensive Solution

## UE Portfolio



CPE 7000  
WiMAX->LTE



CPE 8000  
CPE 9000  
LTE only

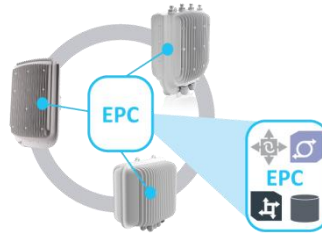


2.5GHz  
MiFi

## BreezeCOMPACT eNodeB



## Embedded EPC BreezeWAY 1010



And/Or

## Centralized EPC BreezeWAY 2020



## BreezeRADIUS



Internet

AAA

3d  
Party  
HSS

## Network Management & Performance Management



## UE/CPE Management (ACS)



## Authentication and Billing Ecosystem



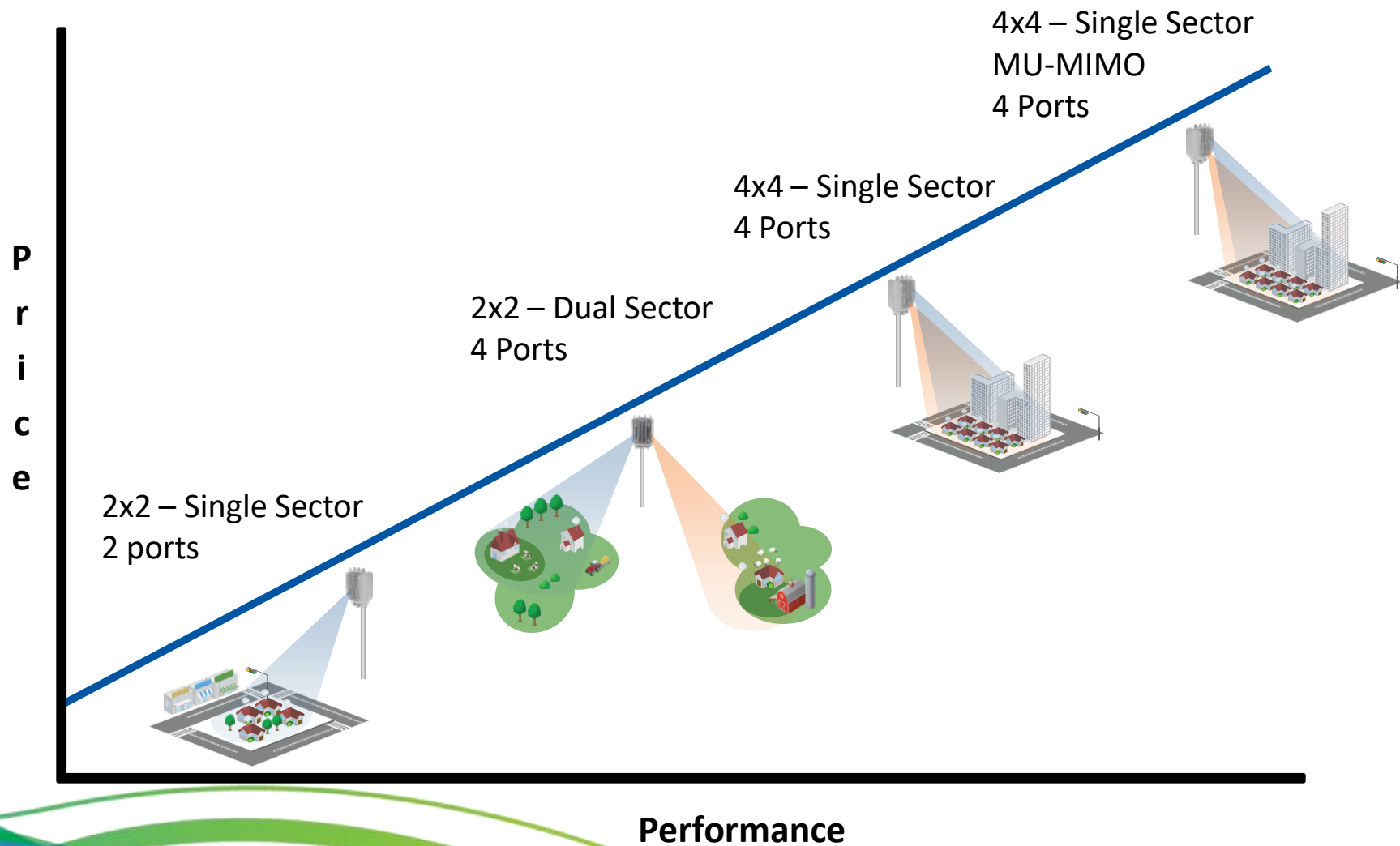


# Telrad is THE Solution for Fixed LTE

- More relevant base station technology
  - ▶ Small cell form factor with macro cell performance
  - ▶ 4x4 that outperforms competitive 2x2 and 8x8 solutions in fixed deployments
- Relevant and cost effective core solution
  - ▶ Distributed, centralized, or mixed
  - ▶ Future virtualized capabilities that leverage current EPC
- Consistent performance and user experience
  - ▶ Reuse strategies that work for fixed
  - ▶ Highest bit/Hz to deliver maximum capacity
- Just-in-time capital model
  - ▶ One platform throughout your network
  - ▶ Start with low CAPEX and grow



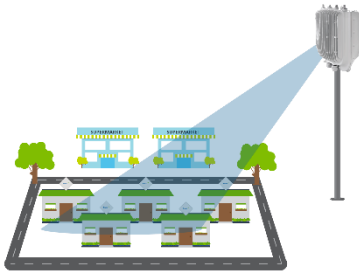
# Just-In-Time Deployment of Capital



# Telrad Business Model - Deployment Flexibility

## 1 Radio, Multiple Deployment Options = Best ROI

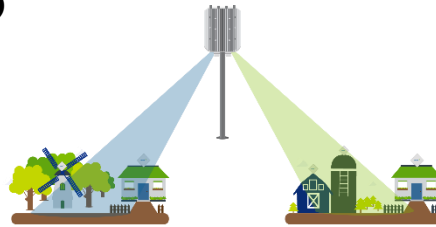
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### Low Density Deployment

2x2 – Single Sector  
100 Mbps Single Sector Capacity  
(20 MHz of Spectrum)  
5.5 bits/Hz | 1 eNodeB | 2 Ports

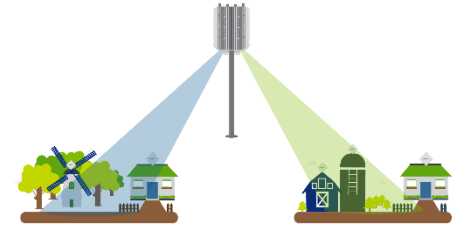
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### Lowest CapEx / Coverage

2x2 – Split Mode (180 degrees opposed)  
100 Mbps shared capacity  
(20 MHz of Spectrum)  
5.5 bits/Hz | 1 eNodeB | 4 Ports

③



### Flexible use of available spectrum

2x2 – Dual Sectors/Dual Carrier  
2 x 50 Mbps Sectors  
(20 MHz of Spectrum)  
5.5 bits/Hz | 1 eNodeB | 4 Ports

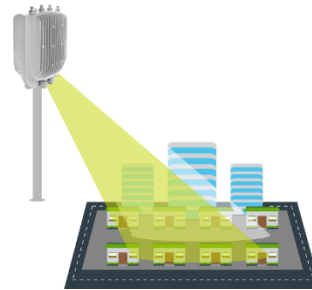
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### Max NLOS Penetration

4x4 TM4 100Mbps  
100 Mbps Single Sector  
(20 MHz of Spectrum)  
5.5 bits/Hz | 1 eNodeB | 4 Ports

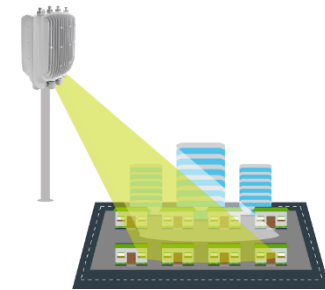
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### Max Peak Rate

Single sector-200 Mbps  
Carrier Aggregation ( non contiguous channels)  
20 + 20 MHz = **40 MHz**  
5.5 bits/Hz | 1 eNodeB | 4 Ports

⑥



### Max spectral efficiency

4x4 – Single Sector  
MU-MIMO  
Single sector **200Mbps**  
**(20 MHz of Spectrum)**  
**10 bits/Hz** | 1 eNodeB | 4 Ports

Increase Subscriber Capacity or Performance

# Servicing a Global Customer Base



# LTE Milestones – Evolution

“EXPANDING CAPACITY”

2014

## Telrad LTE Solution Launch

- LTE RAN – BreezeCOMPACT eNodeB family
- LTE CORE – BreezeWAY 2020 (MC-EPC)
- CPE7000 – Indoor/Outdoor CPE (WiMAX/LTE Rel. 9)
- New NMS – BreezeVIEW

2014

40mbps

100mbps

2015

2015

## Focus on Fixed BWA

- LTE BWA E2E solution/capabilities
- Embedded LTE Core – BreezeWAY 1010
- Performance enhancements
- WiMAX → LTE transition

2016

200mbps

2016

## BWA LTE-Advanced

- LTE Rel. 10
- Carrier Aggregation
- MU-MIMO
- MIMO 4x4
- LTE CPE Cat. 5/6 CPE

2017

>500mbps

2018

2017-18\*

## BreezeCOMPACT eRAN Solution

- LTE Rel. 11 & Beyond
- Cloud RAN Solution
- Small Radio
- eCIC, COMP, Relay

Telrad

\*NOTE: Current plan





Thank You!

[www.telrad.com](http://www.telrad.com)

